Changes for the Better

MITSUBISHI
ELECTRIC

Power Devices HIVC series

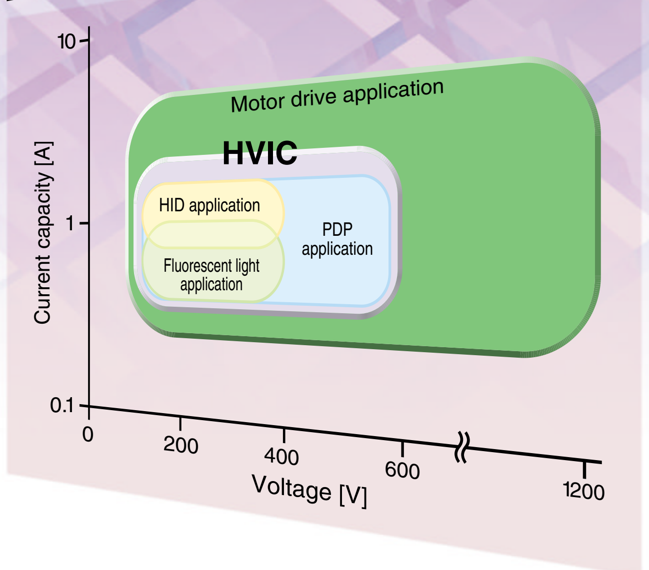
Meets User Needs for Driving Power MOSFET/IGBT

HVIC series

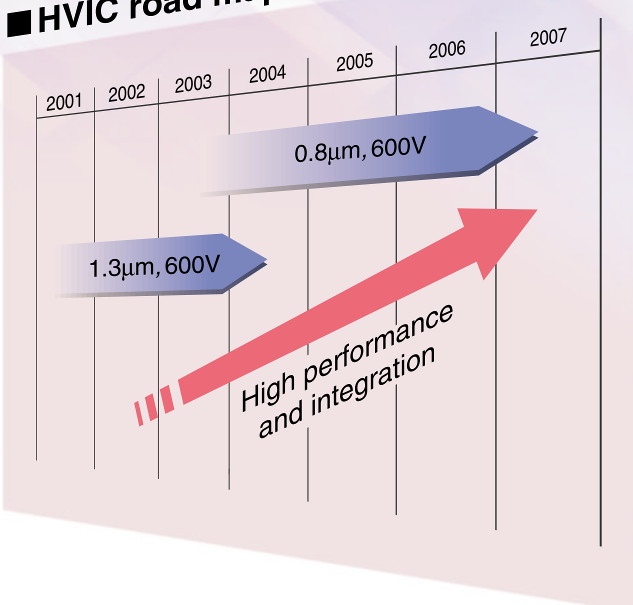
HVIC series

Mitsubishi has utilized its excellent advanced high-voltage process technology and drive protection circuit technology to accurately transmit the microcomputer control signal to the power MOSFET/IGBT with high speed and high reliability without a photo-coupler.

■ Application fields



■ HVIC road map



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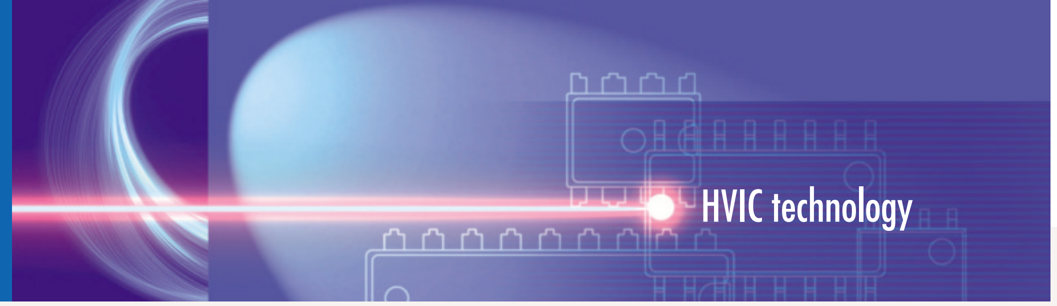
HVIC technology

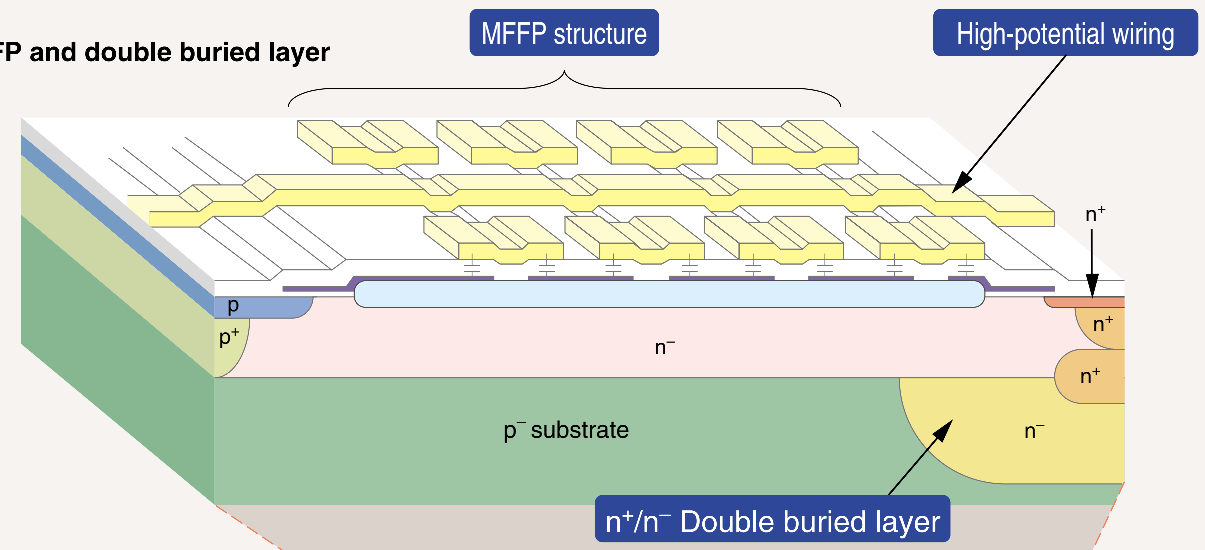


Technology of high voltage devices integration

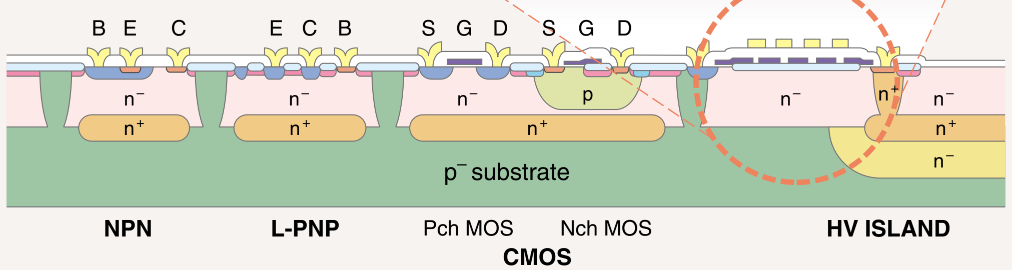
HVIC include junction isolated 600V devices and 5/15V devices

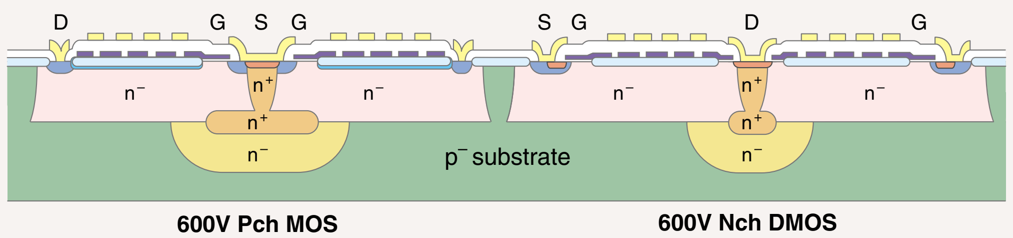
- MFFP (Multiple Floating Field Plate) structure : It is composed of one poly-silicon layer and one aluminum layer , and it is a new electric field relaxation technique.
- Double buried layer structure : High voltage isolation structure with N^+/N^- double buried layer stabilizes breakdown voltage because avalanche position shifts surface of the n- epitaxial layer to the substrate.
- COMS transistor with buried layer latch-up toughness is improved.

■ MFFP and double buried layer



■ 600V BiCMOS/DMOS structure





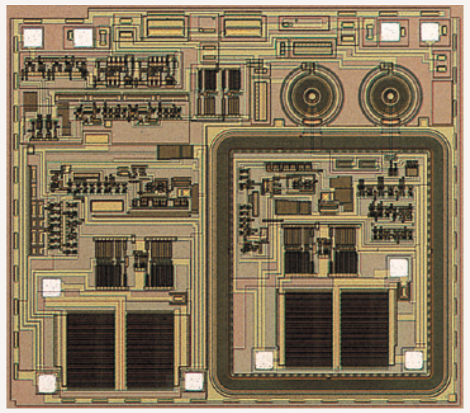
Control circuit technology for analog/digital signal

HVIC is formed high/low side driver, 600V level-shift and under voltage protection. More over the oscillator is embedded in the HVIC.

MCU is able to control MOSFET or IGBT by using HVIC (half bridge driver or full bridge driver) without photo coupler.

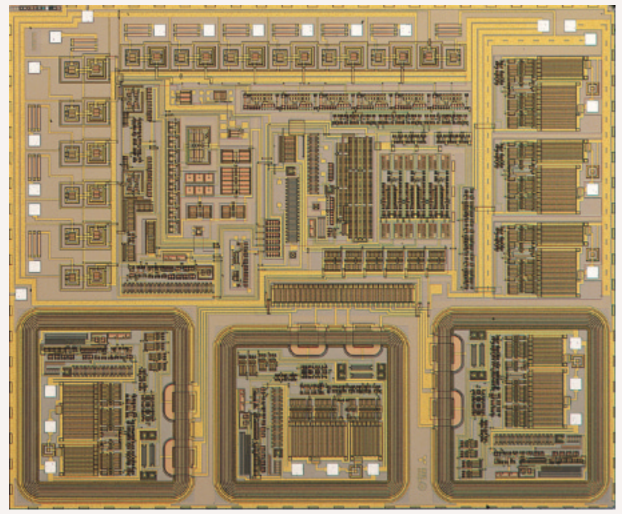
Half bridge driver

Half bridge driver chip

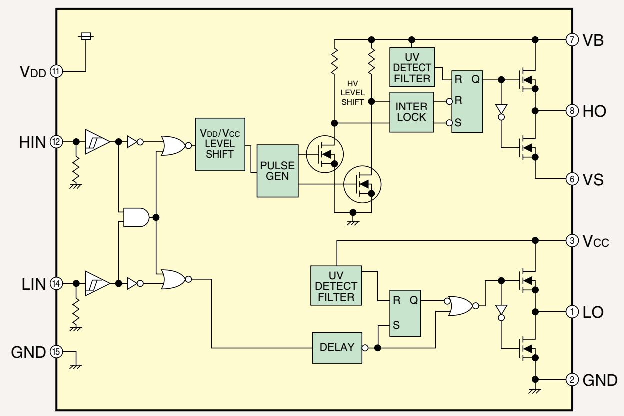


3-phase bridge driver

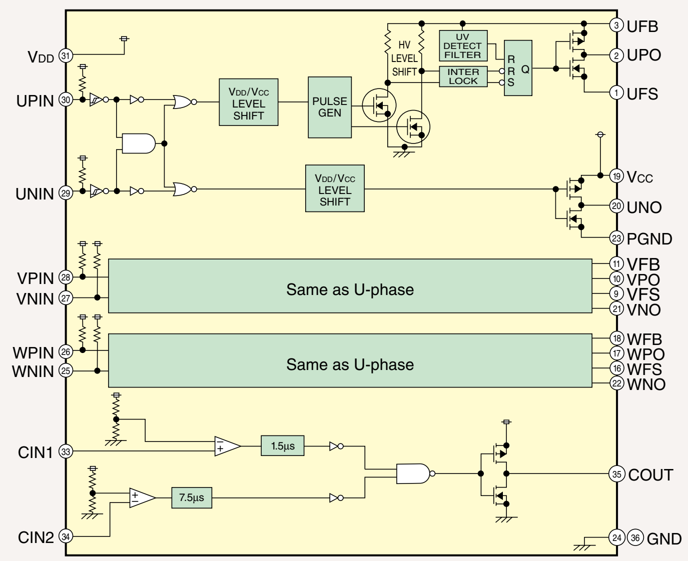
3-phase bridge driver chip



■ Example half-bridge driver circuit configuration



■ Example 3-phase bridge driver circuit configuration

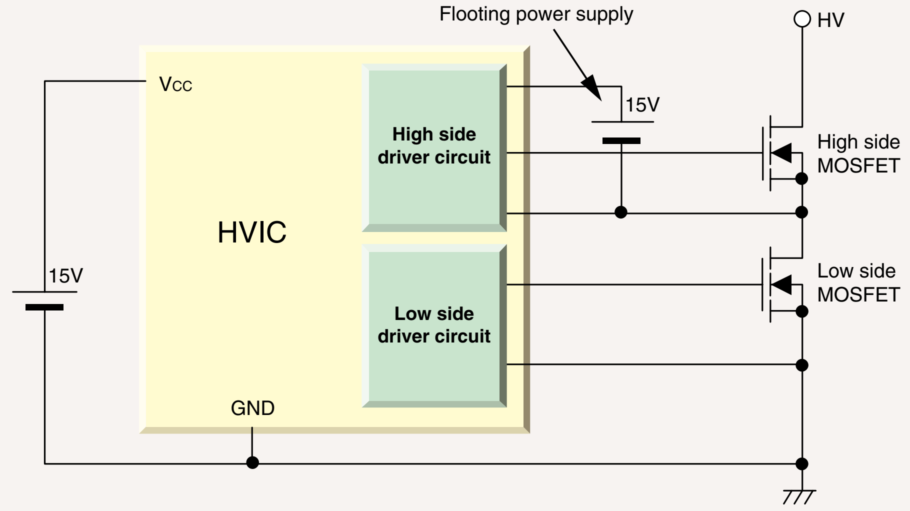


How to use

1 Floating power supply method

The source voltage of high side MOSFET shifts ground level to HV level.
Therefore in order to drive high side MOSFET, the power supply of high side driver needs one Vcc up to source voltage of high side MOSFET.
One solution is floating power supply method.
Typical connection of floating power supply method is shown as follow.

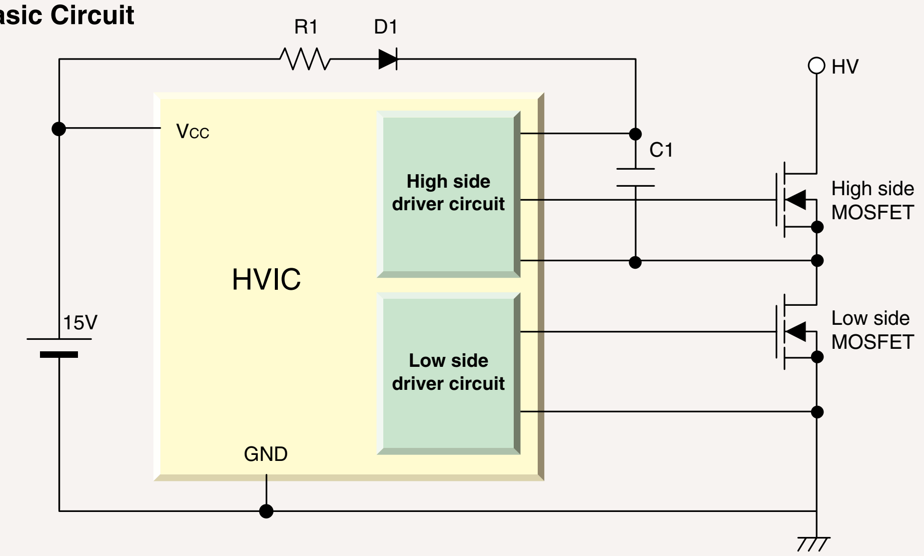
■ High side driver flooting power supply method



2 Boot strap circuit method & basic operation

Another solution is bootstrap circuit method. This method is the use of low side power supply, bootstrap diode D1, resister R1 and bootstrap capacitor C1.
C1 is charged through R1, D1 from Vcc. Circuit diagram are shown as follow.

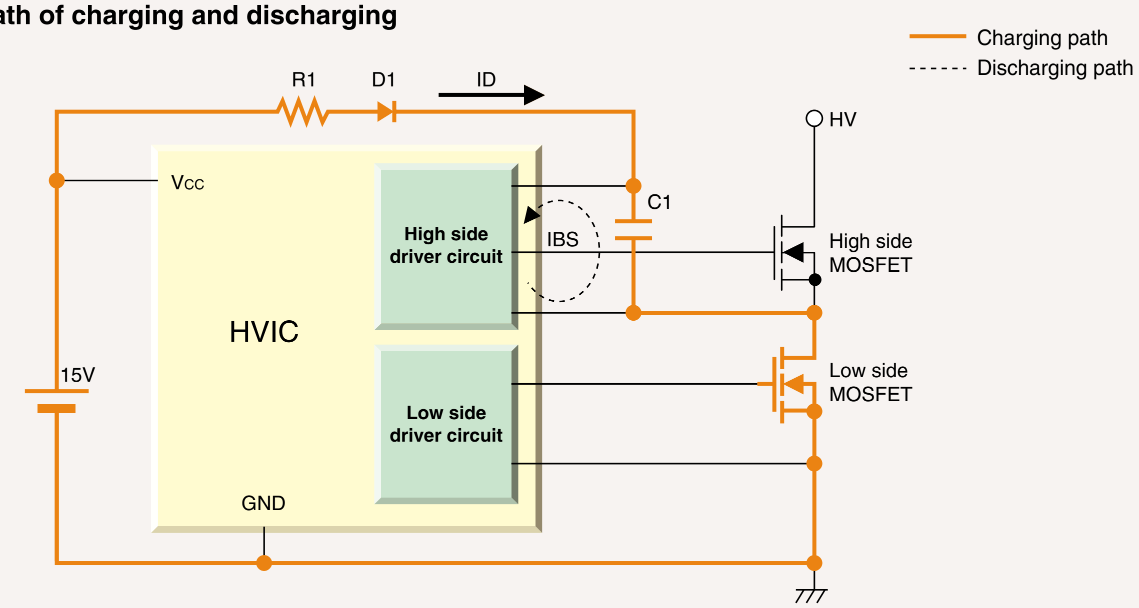
■ Boot strap basic Circuit



3 Current path of charging and discharging during HVIC stationary operation.

Current path of charging and discharging during HVIC stationary operation are shown as follow.

■ Current path of charging and discharging



■ Setting example of boot strap capacitor value

Initial charged voltage of boot strap capacitor

At first low side MOSFET is switched ON mode. Boot strap capacitor is charged by this.

Charging current ID is given by

ID= (Vcc/R1)$e^{-t/(R1 \cdot C1)}$ Initial condition t=0

ID=Vcc/R1

When charged voltage VC1 of boot strap capacitor C1 can be expressed as (1)

VC1=Vcc－VF－VDS ··· (1)

VF : Forward voltage of diode D1
VDS: drain-source voltage of low side MOSFET

Simplified calculation of boot strap capacitor value

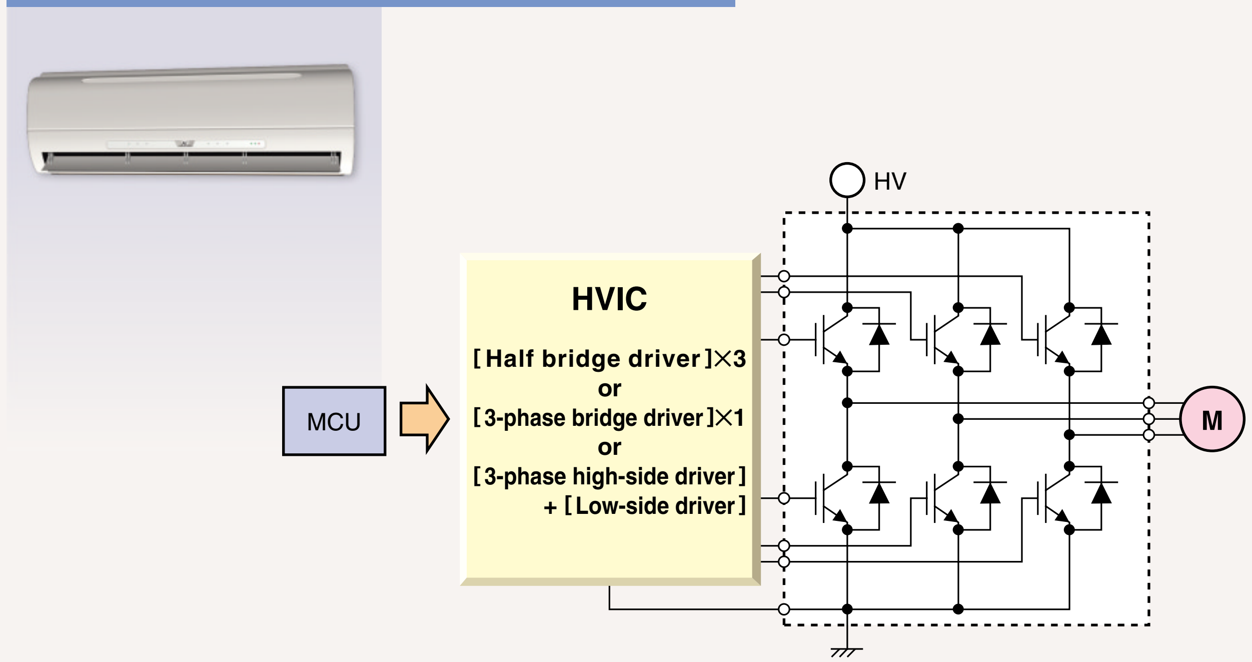
Boot strap capacitor value can be expressed as (2)

C1=IBS×T1/ΔV+ (Margin : 2～3 times of IBS×T1/ΔV) ··· (2)

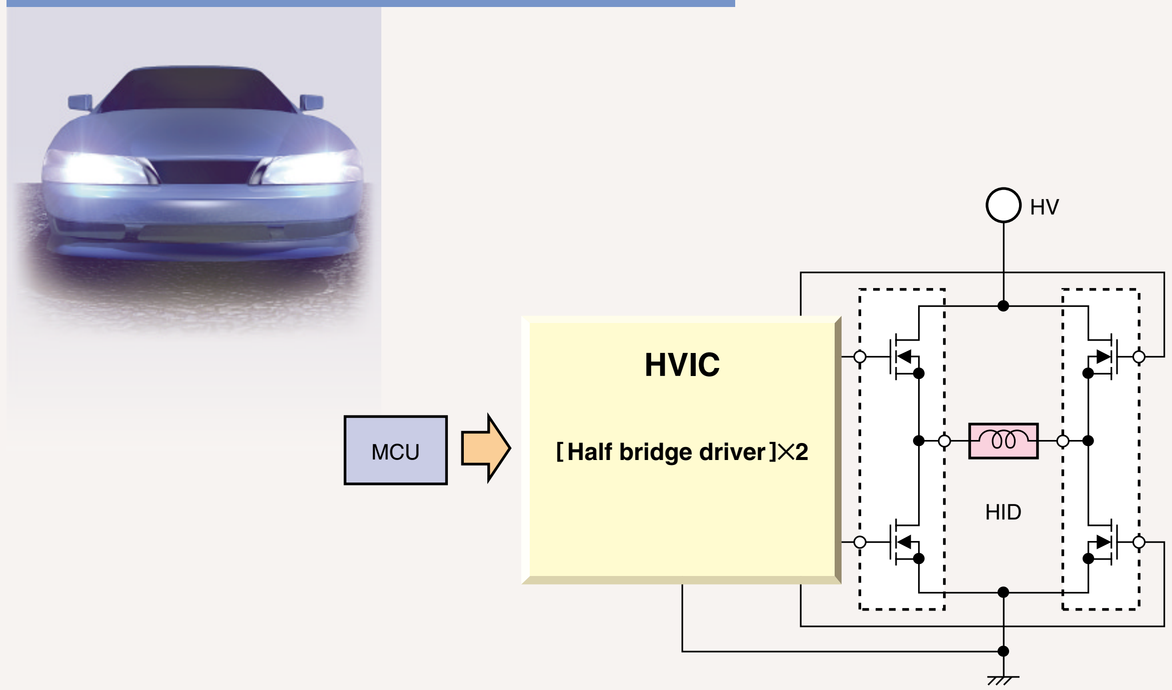
T1 : maximum time of high side MOSFET is ON (or maximum time of high side MOSFET and low side MOSFET are OFF)
IBS: High side Consumption current (consider Temperature characteristic and Frequency characteristic)
ΔV : maximum voltage when C1 discharges electricity

C1 is calculated by (1) (2), expression
This setting example is only calculation, so you should design with investigation of your actual set.

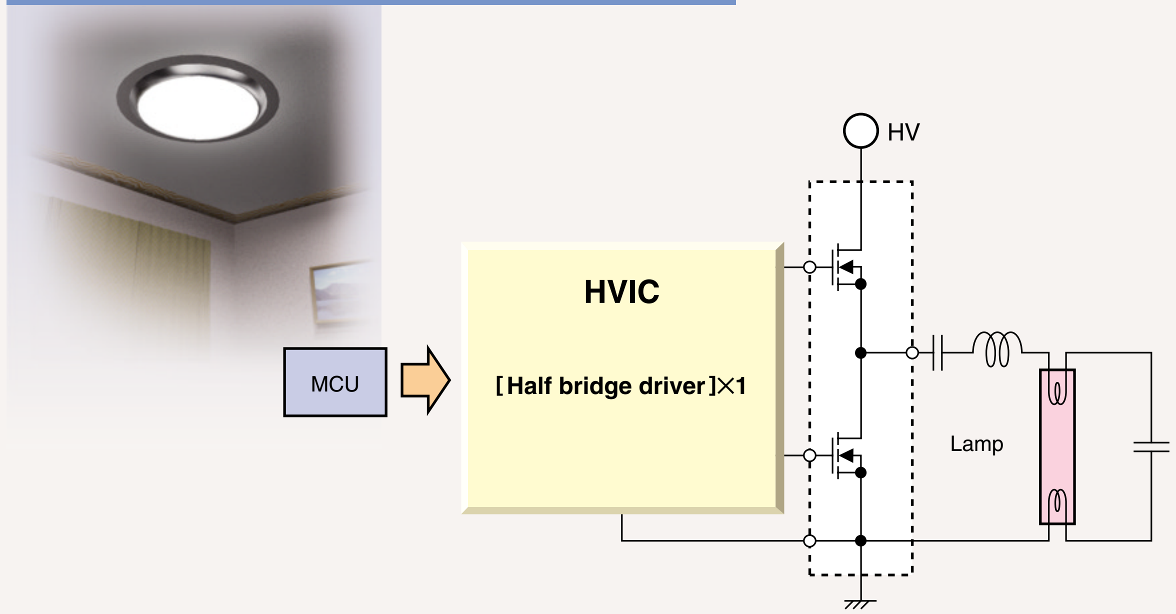
Example motor drive configuration



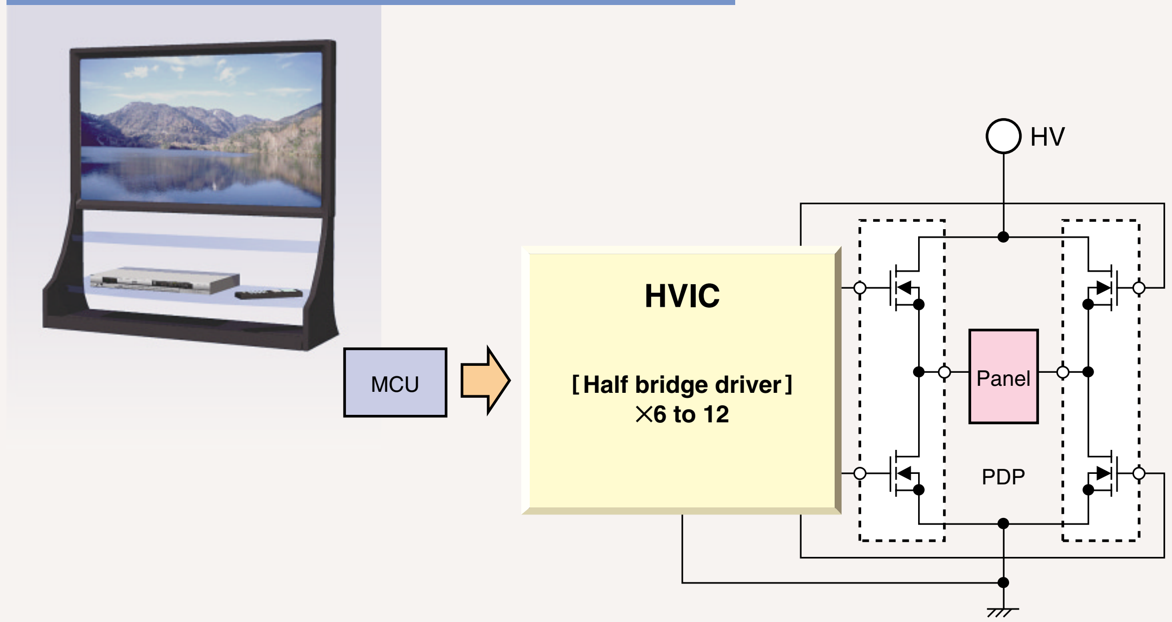
Example HID drive configuration



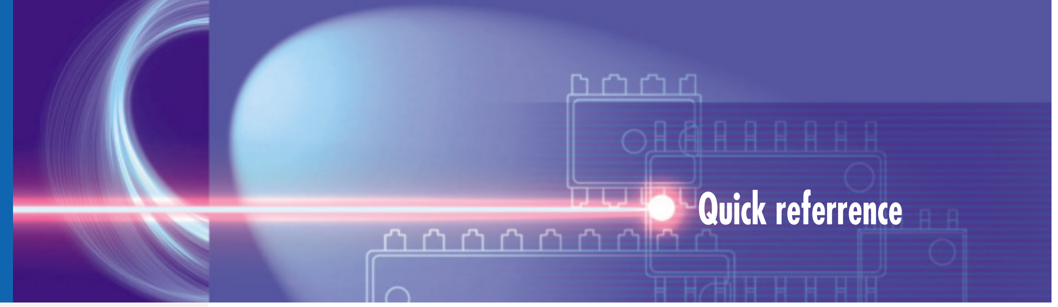
Example fluorescent light drive configuration



Example PDP drive configuration



Quick referrence



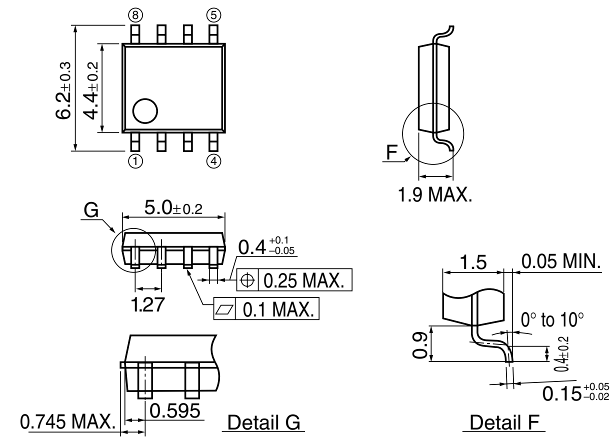
Type name	Rating voltage (V)	Output current (A)	Drive type	Input signal	Dead-time control	Remarks	Pakage
M81706AFP (pb free)	600	+0.12/ −0.25	Half bridge drive	2	Input signal	with Interlock	8P2S ①
M81707FP (pb free)		0.1	Dual high side drive	1×2		—	16P2N ②
M81708FP (pb free)		+0.12/ −0.25	Half bridge drive	2		with Interlock	
M81709FP (pb free)		2					
M81711FP (pb free)	24	0.5	Dual low side drive	1×2	—	Low active	8P2S ①
M81716FP (pb free)						High active	
M81713FP (pb free)	600	0.5	Half bridge drive	1	Internal	—	
M81719FP ★ (pb free)		+0.12/ −0.25		2	Input Signal	with Input filter	
M81712FP ★ (pb free)		+0.2/ −0.35	3ø Bridge drive	6		with Interlock	28X9R ③
M81019FP (pb free)	1200	1	Half bridge drive	2			24P2Q ④
M81721FP (pb free)	600					for DIP-CIB	
M81722FP ★ (pb free)		3				—	8P2S ①
M81723FP ★ (pb free)	300	0.1	Dual high side drive	1×2	—		16P2N ②
M81725FP ★ (pb free)	600	3	High side drive	1			8P2S ①
M63958P/FP ★ (pb free)		+0.5/ −0.25	Half bridge drive	—	Internal	for Fluorescent lamp	16P4⑤/16P2N②

★ : Under development

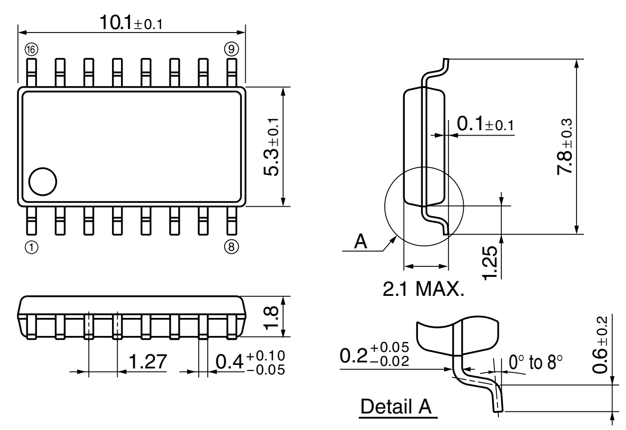
(Unit : mm)

Pakage outline

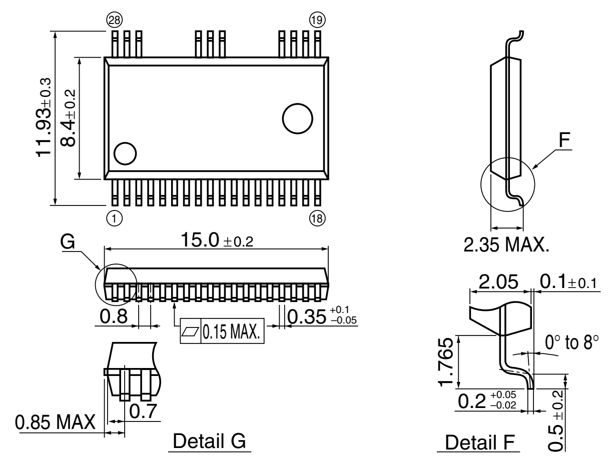
① **TYPE 8P2S** 8pin 225mil SOP



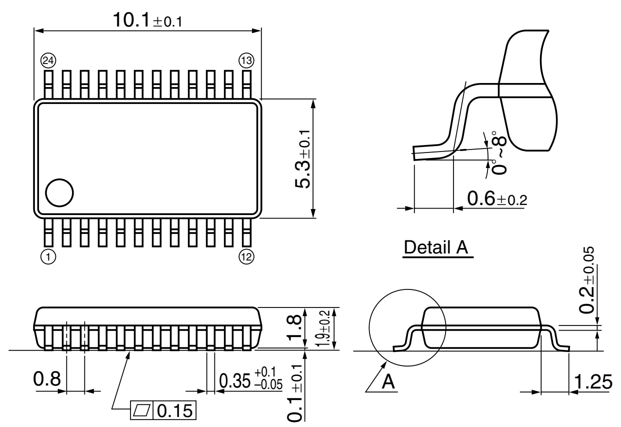
② **TYPE 16P2N** 16pin 300mil SOP



③ **TYPE 28X9R** 28pin 450mil SSOP



④ **TYPE 24P2Q** 24pin 300mil SSOP



⑤ **TYPE 16P4** 16pin 300mil DIP